

Update on How COVID-19 Is Affecting Traffic and Emissions



MAG Air Quality Technical Advisory Committee
January 28, 2021

ENVIRONMENTAL PROGRAMS

Impacts of Telecommuting and Stay-at-Home COVID-19 Restrictions on Regional Traffic

- **MAG continues to track the impacts of COVID-19 restrictions on traffic on a dedicated webpage:**
<https://azmag.gov/Newsroom/MAG-News/ArticleId/153/covid-19s-effect-on-regional-traffic>
- **At the May 21, 2020 AQTAC Meeting, MAG reported that when compared to “normal” levels as observed on March 1, 2020, traffic speed and volume data through May 15, 2020 show the impact of COVID-19 restrictions on regional freeways and arterials:**
 - **Less congestion – higher average speeds means faster travel times and less delay.**
 - **Average weekday traffic volume decreased to as low as 63% of March 1 levels during the second week of April.**
 - **COVID-19 hasn’t stopped freight deliveries. Unlike commute traffic, daily traffic for heavy trucks has stayed consistent.**



ENVIRONMENTAL PROGRAMS

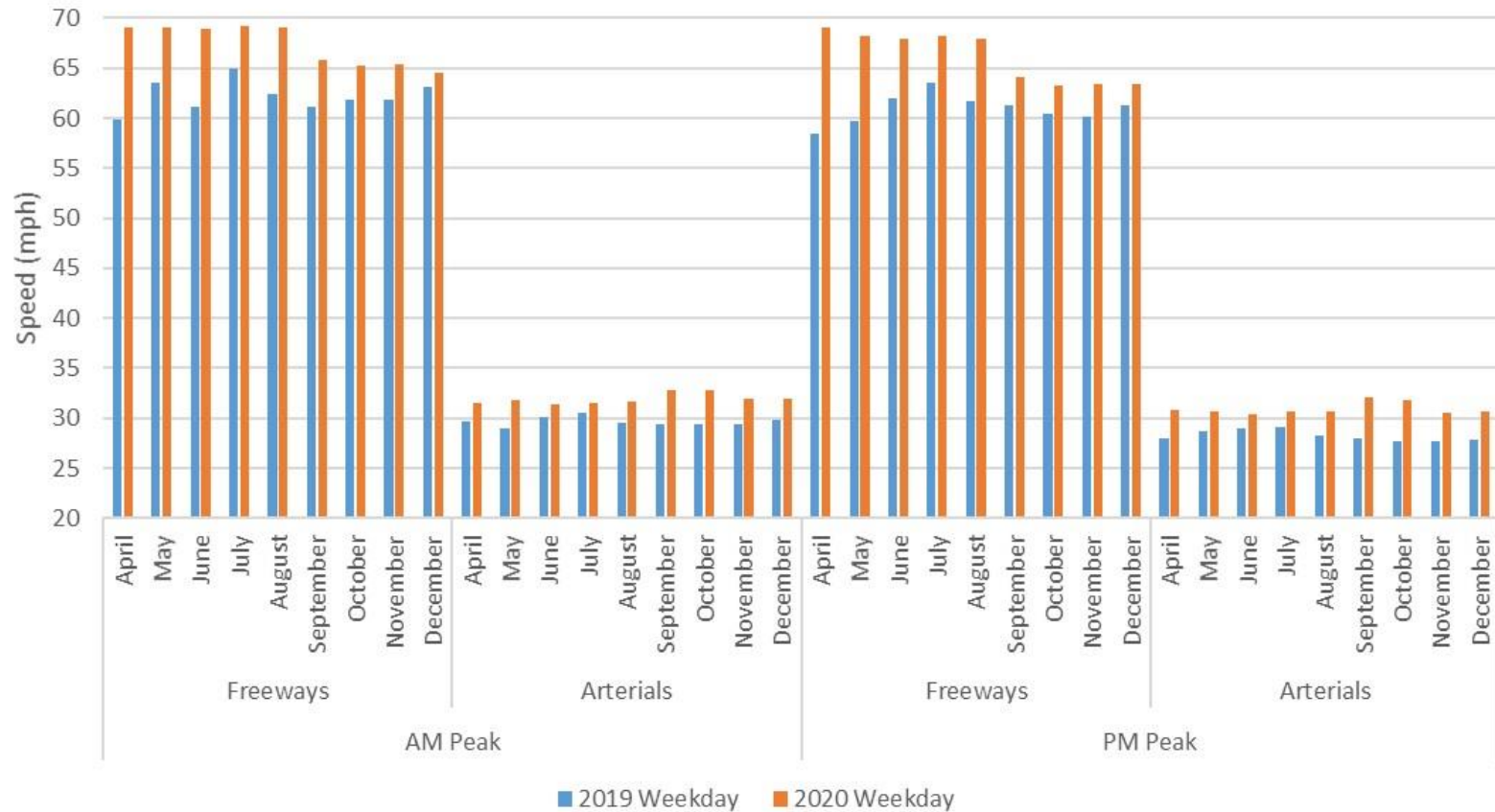
Impacts of Telecommuting and Stay-at-Home COVID-19 Restrictions on Regional Traffic

- **Since May 2020, updated traffic data finds that when compared to “normal” levels as observed on March 1, 2020, traffic speed and volume data through January 8, 2021 show the impact of COVID-19 restrictions on regional freeways and arterials:**
 - **Continued less congestion – higher average speeds are still observed on freeways and arterials. After August 2020, freeway speeds began to decrease as compared to March-August 2020 as traffic volumes increased.**
 - **Average weekday traffic volumes are still lower than pre-COVID-19 volumes, but have rebounded to 90% of March 1, 2020 volumes as of January 8, 2021.**
 - **Since May 2020, heavy truck traffic has increased. As of January 8, 2021, heavy truck traffic is 122% of March 1, 2020 levels.**

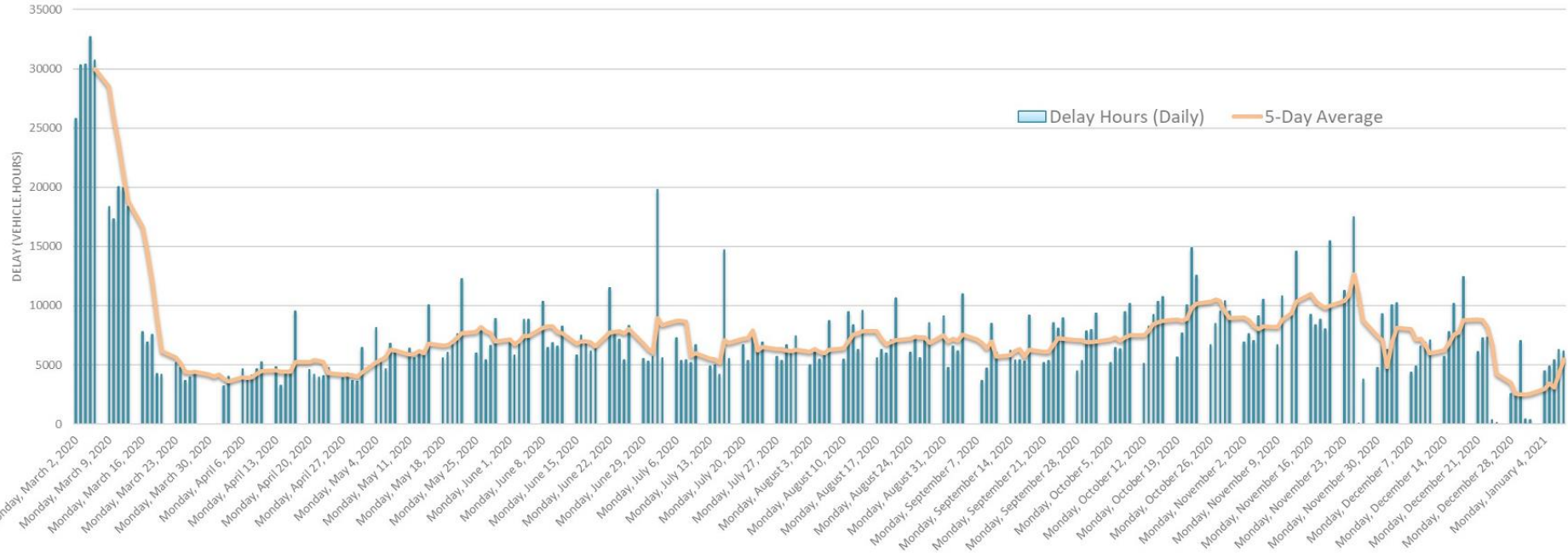


COVID-19 Impact to Average Weekday Vehicle Speeds in Maricopa county

(Data Source: INRIX Speed Data in 2019 and 2020)

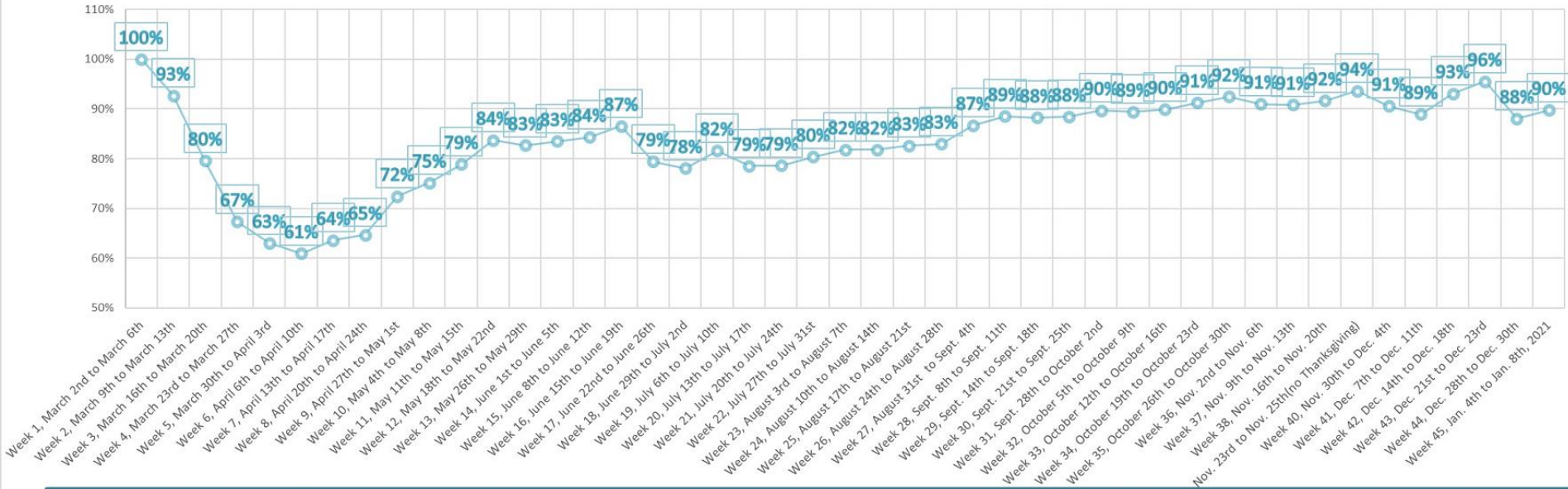


Traffic Congestion Delay in Maricopa County (freeway and state highway- updated through January 8, 2021)



- The measure of congestion delay is calculated from speed data, which covers all major freeways and highways in Maricopa County, 24/7.
- The speed data is provided to MAG by a third-party company called INRIX via ADOT licensing (www.inrix.com) from an analytic platform powered by CATT lab(ritis.org).
- The delay (vehicle hours) is calculated as the excessive travel time for all vehicles when average speed during a given hour is at least 20mph lower than the free-flow speed. The daily delay is calculated as the sum of hourly delay per day in the region.

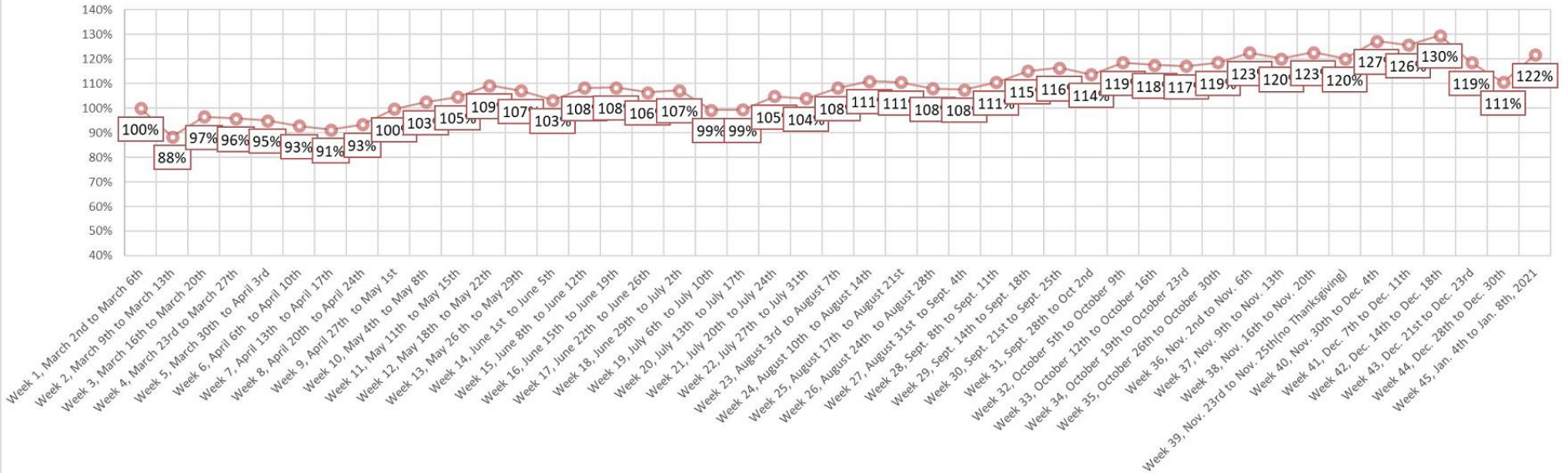
Average Weekday Traffic Volume (vehicles traveled) Compared to Normal Condition in Maricopa County



-If we assume the traffic in week 1 of March as normal condition, the percentage is calculated as average weekday daily traffic in a given week compared to average weekday daily traffic in week 1 of March, 2020.

-The traffic volume data is provided by ADOT on selected automatic traffic recorders on freeways and arterial streets in Maricopa county.

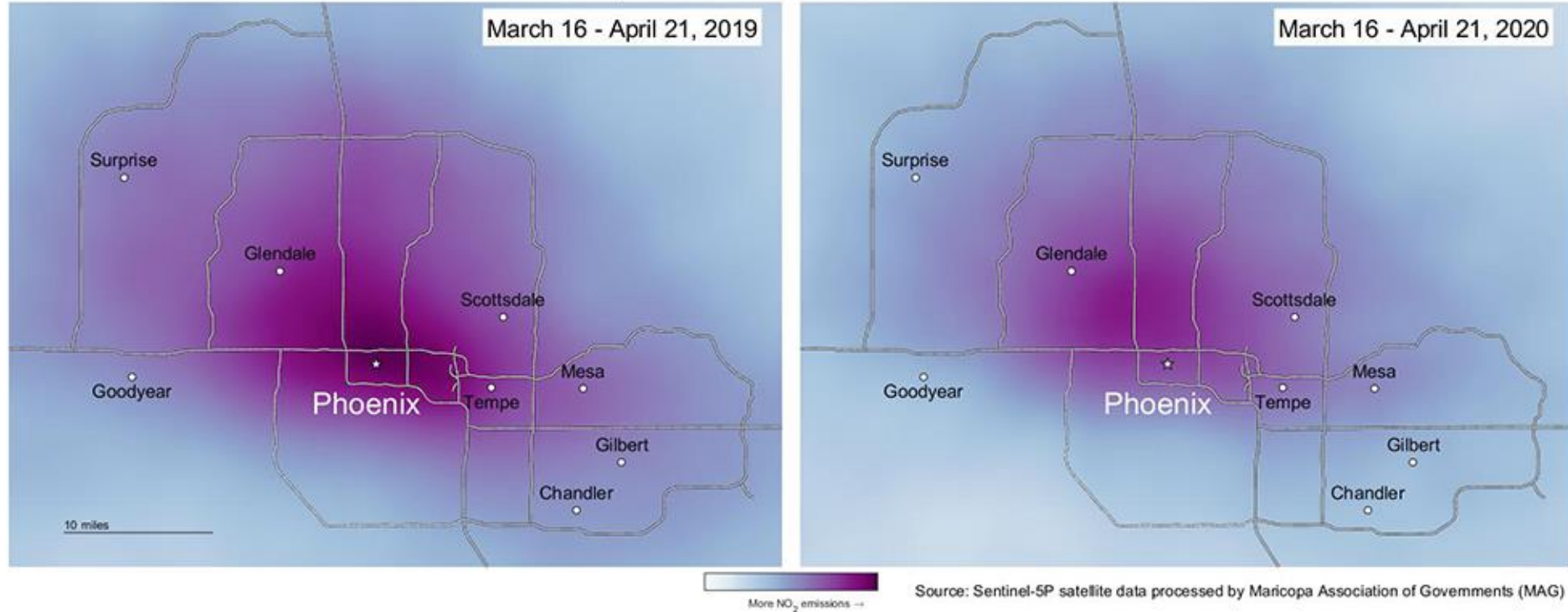
**Average Weekday Daily Traffic of Heavy Trucks
Compared to Normal Condition in Maricopa County**



-The heavy truck volume data is provided by ADOT on selected automatic traffic recorders on freeways and arterial streets in Maricopa county. The heavy truck is defined as a truck with single-trailer or multi-trailer and more than 2-axle.

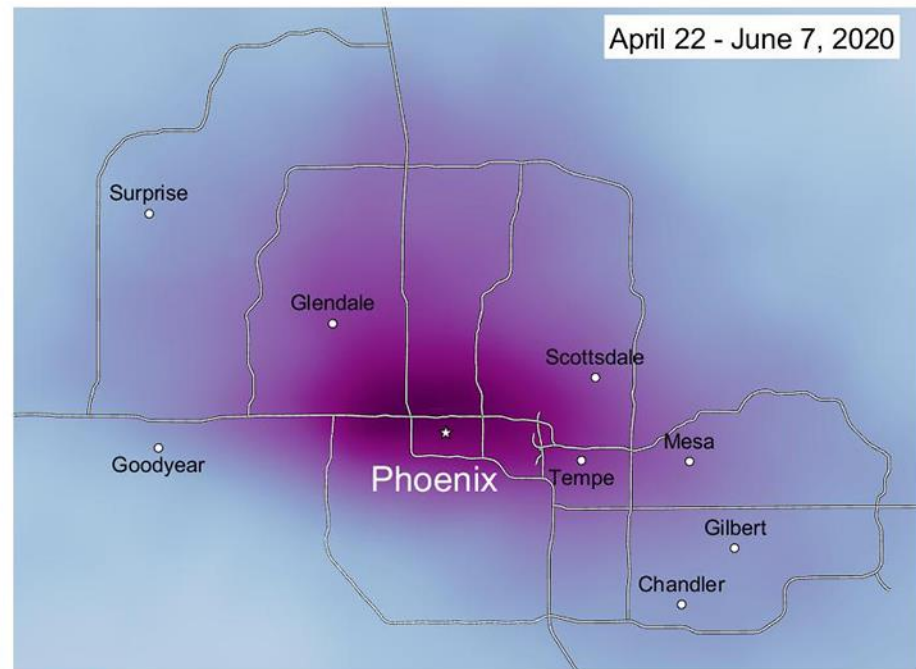
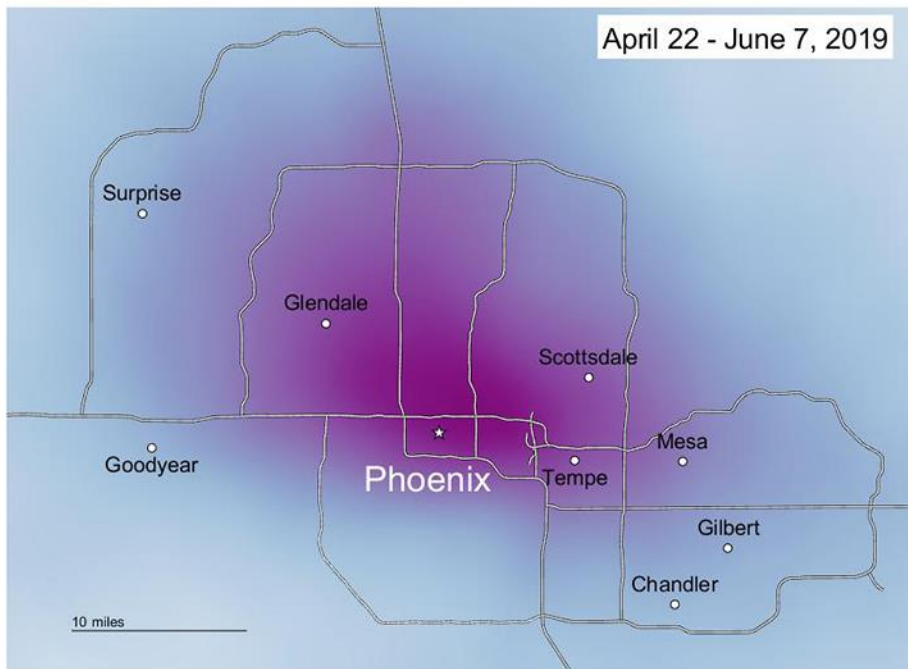
-The percentage is calculated as average weekday daily traffic of heavy truck during normal condition in week 1 of March, 2020.

Satellite measured NO₂ emissions
over Phoenix metropolitan area before and after COVID-19 lockdowns



Average daily **decrease** of 16.95% in NO₂ emissions for this period (March 16 - April 21).

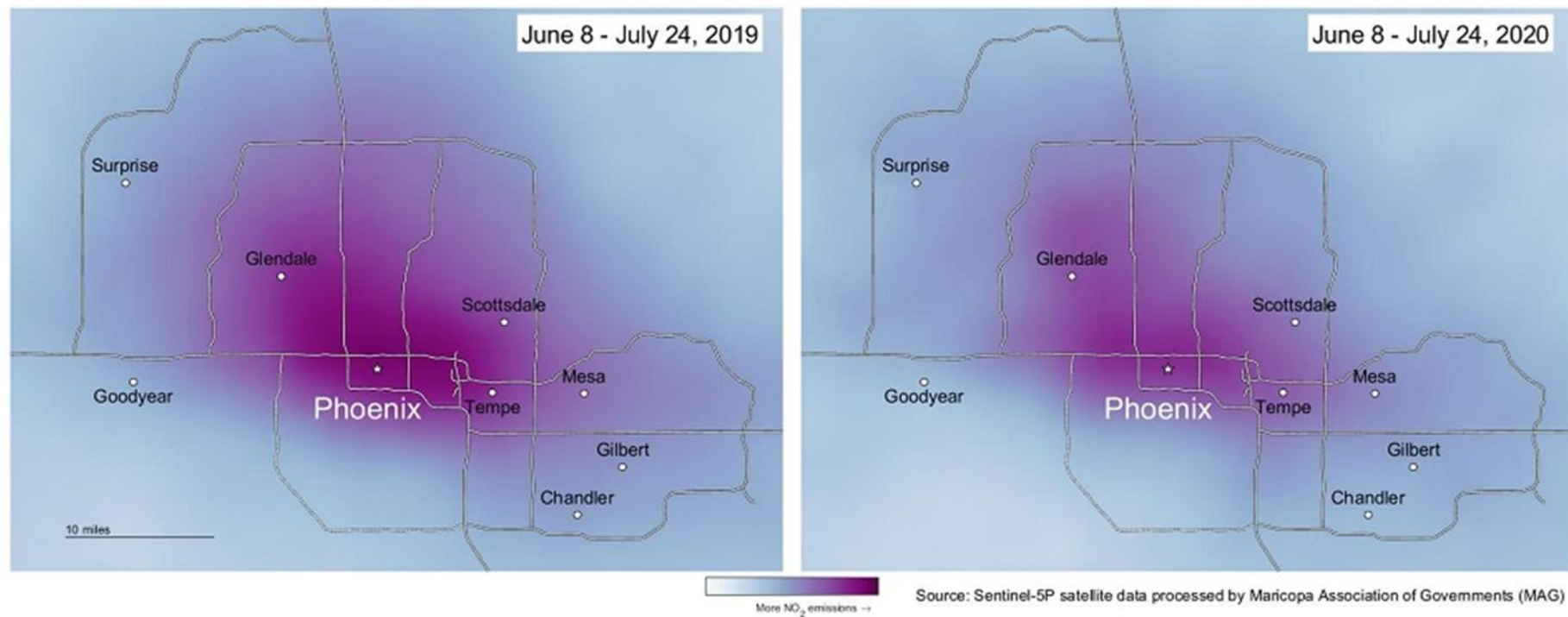
Satellite measured NO₂ emissions over Phoenix metropolitan area



Source: Sentinel-5P satellite data processed by Maricopa Association of Governments (MAG)

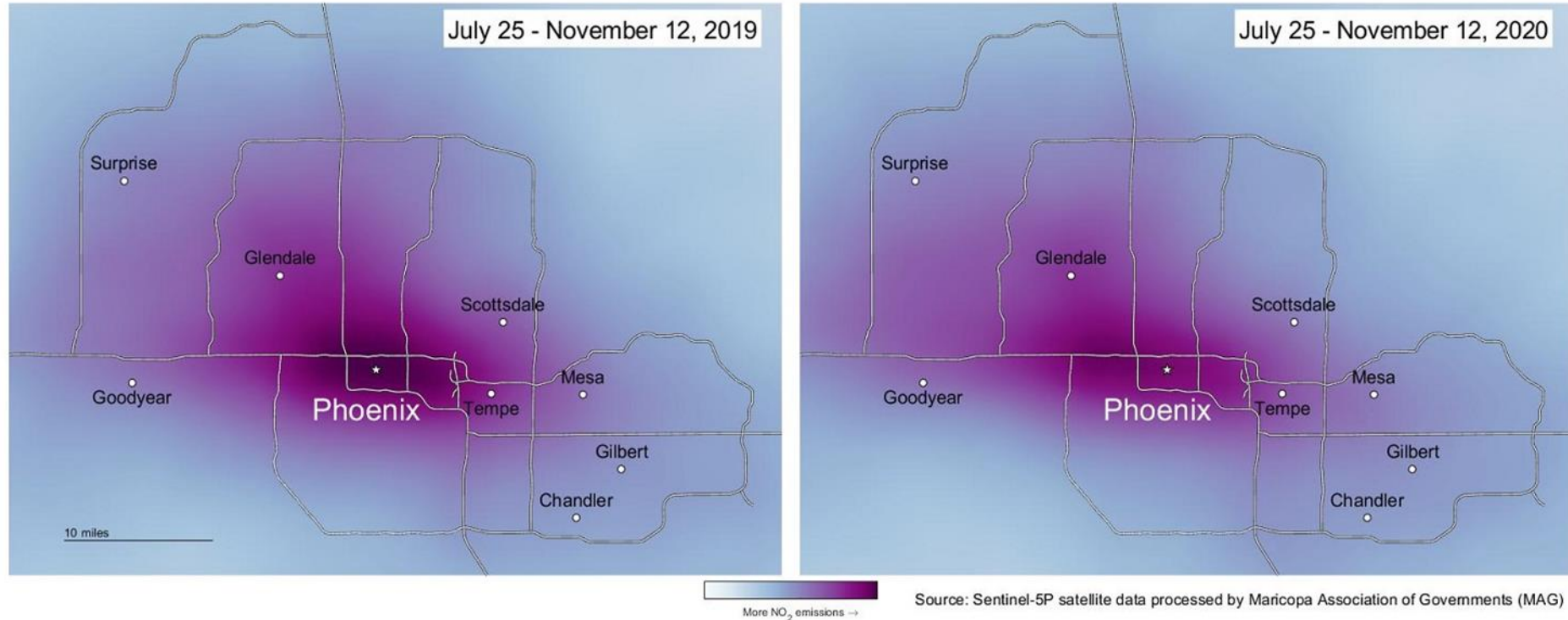
Average daily **increase** of 11.44% in NO₂ emissions for this period (April 22 – June 7).

Satellite measured NO₂ emissions over Phoenix metropolitan area



Average daily **decrease** of 10.27% in NO₂ emissions for this period (June 8 – July 24).

Satellite measured NO₂ emissions over Phoenix metropolitan area



Average daily *decrease* of 2.71% in NO₂ emissions for this period (July 25 – November 12).

National Articles Continue to Highlight Complex Relationships Between COVID-19 Restrictions and Air Quality

- **“Traffic Is Way Down Because Of Lockdown, But Air Pollution? Not So Much:”**
(May 19, 2020, National Public Radio)
<https://www.npr.org/sections/health-shots/2020/05/19/854760999/traffic-is-way-down-due-to-lockdowns-but-air-pollution-not-so-much>
- **“COVID-19 lockdowns had strange effects on air pollution across the globe”**
(September 25, 2020, Chemical & Engineering News)
<https://cen.acs.org/environment/atmospheric-chemistry/COVID-19-lockdowns-had-strange-effects-on-air-pollution-across-the-globe/98/i37>
- **“Did COVID Lockdowns Really Clear the Air?”**
(December 21, 2020, Bloomberg CityLab)
<https://www.bloomberg.com/news/articles/2020-12-21/what-covid-lockdowns-did-for-urban-air-pollution>

National Articles Continue to Highlight Complex Relationships Between COVID-19 Restrictions and Air Quality

- **“Car traffic across the country is down about 40%, but ozone pollution has barely decreased compared with levels over the past five years. Factories, refineries, power plants and diesel trucks are still dominant sources of pollution in many places.” (NPR, May 2020)**
- **“A study based on data from satellites at more than 10,000 ground-based monitoring stations around the world found that average global air quality during lockdowns improved relative to the same periods in 2019...The same study found that even as NO emissions plummeted 60% and fine particulate matter dropped 31%, global average ozone went up slightly around the world.” (Chemical & Engineering News, September 2020)**
- **“It’s not so linear,” says Rima Habre, who studies the connection between health and air pollution at the University of Southern California. When human emissions go down, she says, “pollutants like ozone that form in the air can actually go up in nonstraightforward ways.” In fact, dramatic cuts in primary emissions seem to have triggered severe air pollution events. In northern China and in the Los Angeles area, for example, the strictest lockdown periods saw unusually intense ozone spikes.” (Chemical & Engineering News, September 2020)**

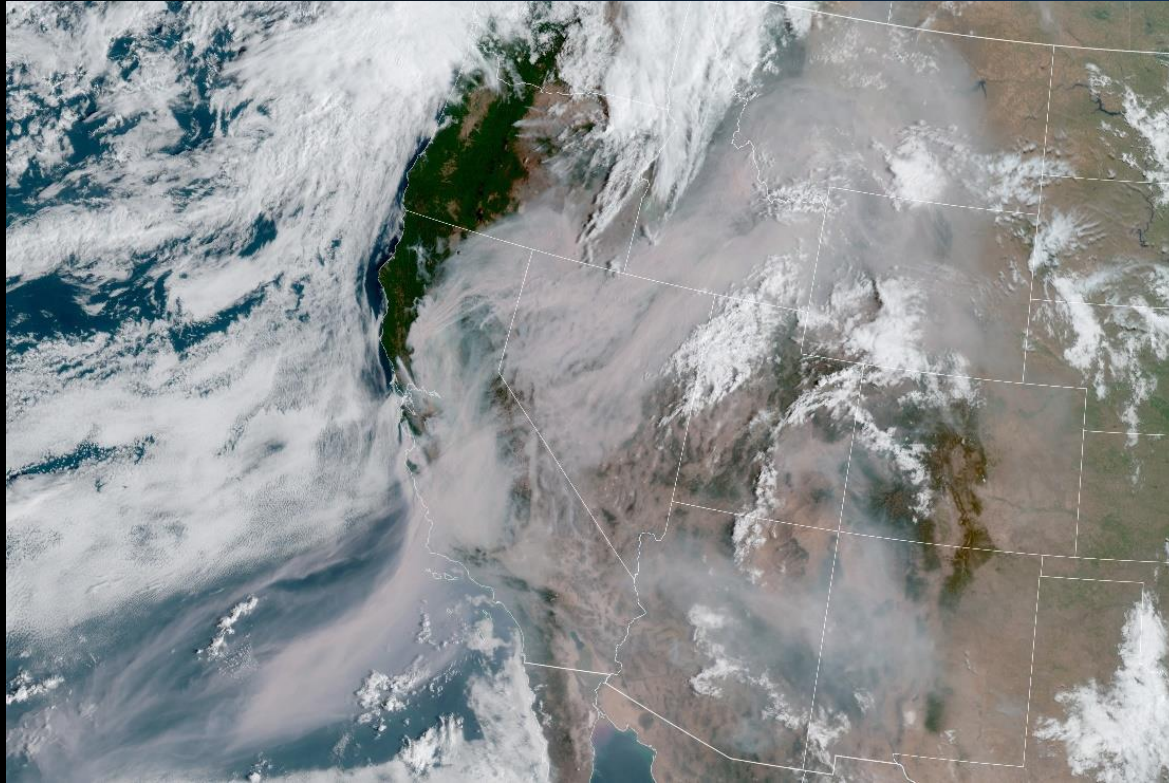
National Articles Continue to Highlight Complex Relationships Between COVID-19 Restrictions and Air Quality

- **“Unraveling the connections between local lockdowns and air quality is not as simple as comparing readings from month to month or year to year; researchers must take into account the impact of weather, regulatory changes and emissions from abroad. Forthcoming studies will go deep into the chemical makeup of the air.” (Bloomberg News, December 2020)**
- **“Research from the University of Washington found no clear story on particulate pollution: California’s PM levels steadily rose during the stay-at-home period, while those in New York State stayed remarkably consistent even as traffic and economic patterns changed with lockdown restrictions. That, said research author Bujin Bekbulat, shows that the complexity of particulates means “if we really want to get pollution down, it might take more than just stay-at-home orders.”” (Bloomberg News, December 2020)**

Recap: Early Summer High Ozone Episodes (April 28 - May 6, 2020) May Have Been Affected by the Following:

- **Discussed at May 21, 2020 AQTAC Meeting.**
- **Meteorological conditions were conducive to ozone formation (high air pressure and temperature, stagnant air mass, and strong sunlight).**
- **Background ozone increased due to transport from California and Mexico, East Asia transport, and biogenic VOC emission increase.**
- **NO_x and VOC photochemical reactions affected ozone formation in the troposphere.**
- **Local emissions contributions to ozone for the period were not clear due to limited data (e.g., power plant's continuous emission monitoring system (CEMS) data, industrial and commercial emission data, nonroad mobile source emissions, etc.).**

Mid-Late Summer High Ozone Episodes (June - September 2020) Were Dominated by Episodes Linked to Wildfires:



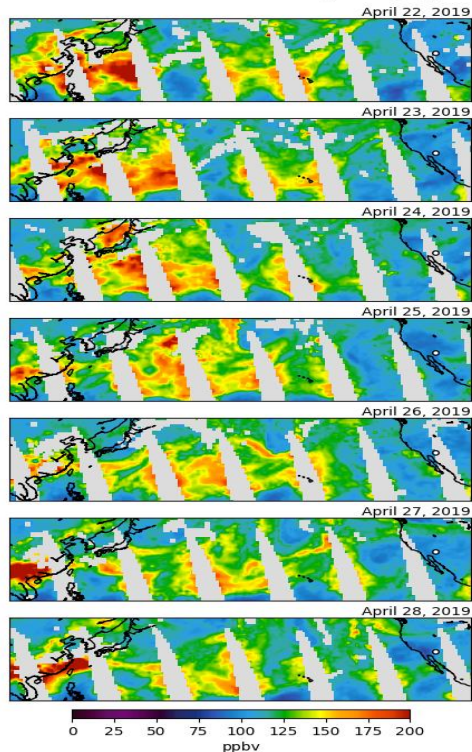
- **A record-setting 2020 wildfire season occurred throughout the Western United States, particularly in California, Colorado and Oregon.**
- **The months with the highest wildfire activity were August and September.**
- **In the Maricopa region, highest ozone concentrations occurred in August when wildfires were burning intensely.**
- **Wildfire impacts likely overwhelmed the impacts of COVID-19 restrictions in the later months of the ozone season.**

Image from: "Wildfire Smoke Shrouds the U.S. West" (NASA Earth Observatory, August 2020)
<https://earthobservatory.nasa.gov/images/147151/wildfire-smoke-shrouds-the-us-west>

East Asia Air Pollutant Transport in April and May

Less East Asia Transport in 2019

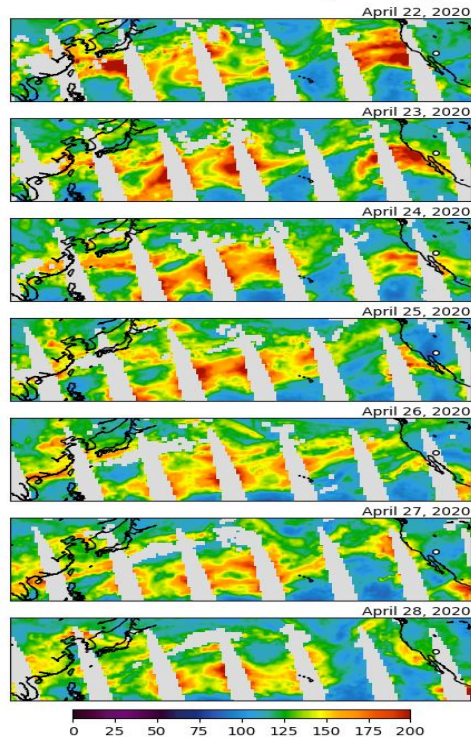
AIRS 500hPa CO Volume Mixing Ratio (day)



Plot created 2019-07-23 09:58:55

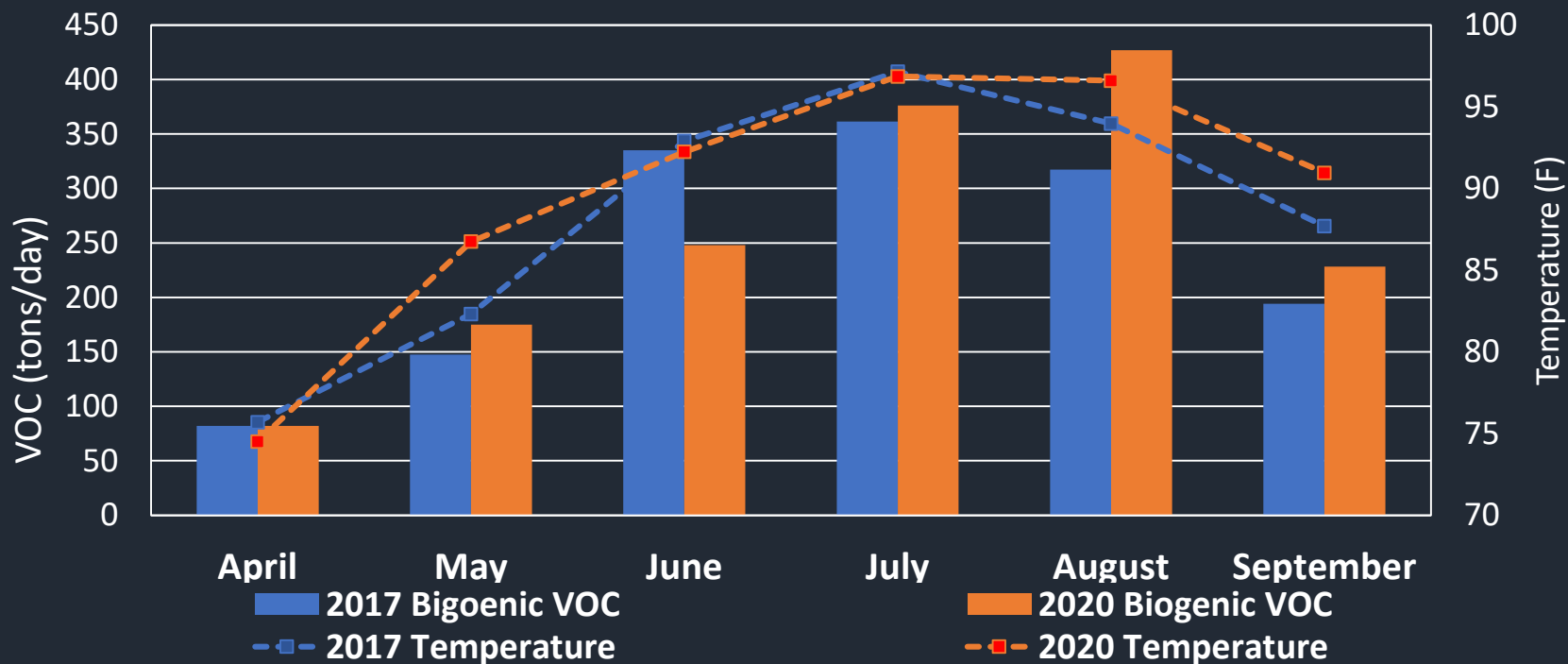
More East Asia Transport in 2020

AIRS 500hPa CO Volume Mixing Ratio (day)



Plot created 2020-05-01 16:24:01

Average Daily Biogenic VOC Emissions and Temperature by Month in 2017 and 2020 in the Maricopa Nonattainment Area



Weather Research and Forecasting (WRF)

Wind Fields for early summer and monsoon season

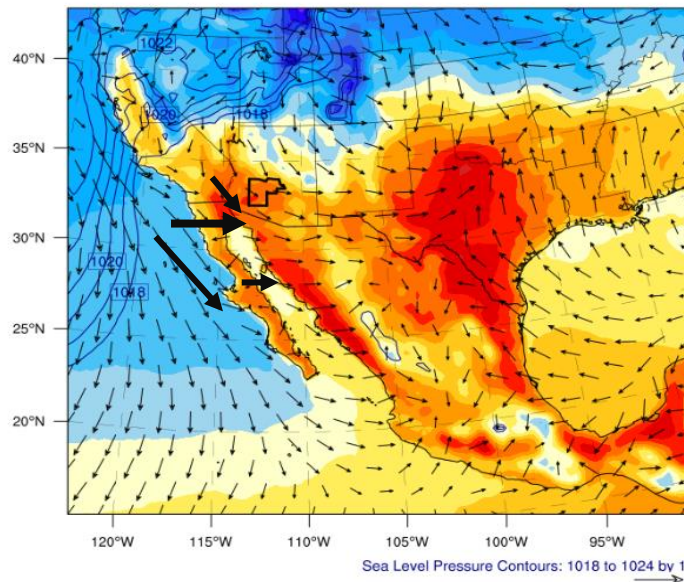
REAL-TIME WRF

REAL-TIME WRF

WRF UTC: 2020-05-04_23:00:00
Local Time: 2020-05-04_16:00:00

Air Temperature at 2m (F)
Sea Level Pressure (hPa)
Wind Vector at 10m (m s⁻¹)

Early Summer



Air Temperature at 2m (F)



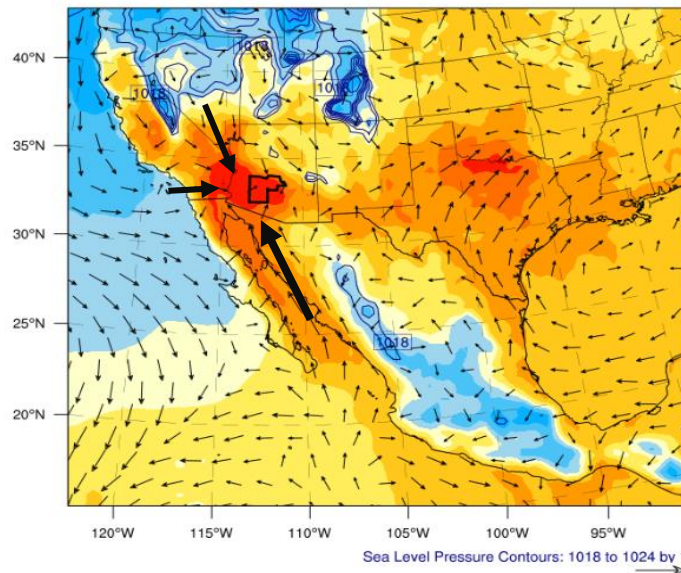
REAL-TIME WRF

REAL-TIME WRF

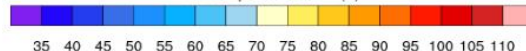
WRF UTC: 2020-08-14_15:00:00
Local Time: 2020-08-14_08:00:00

Air Temperature at 2m (F)
Sea Level Pressure (hPa)
Wind Vector at 10m (m s⁻¹)

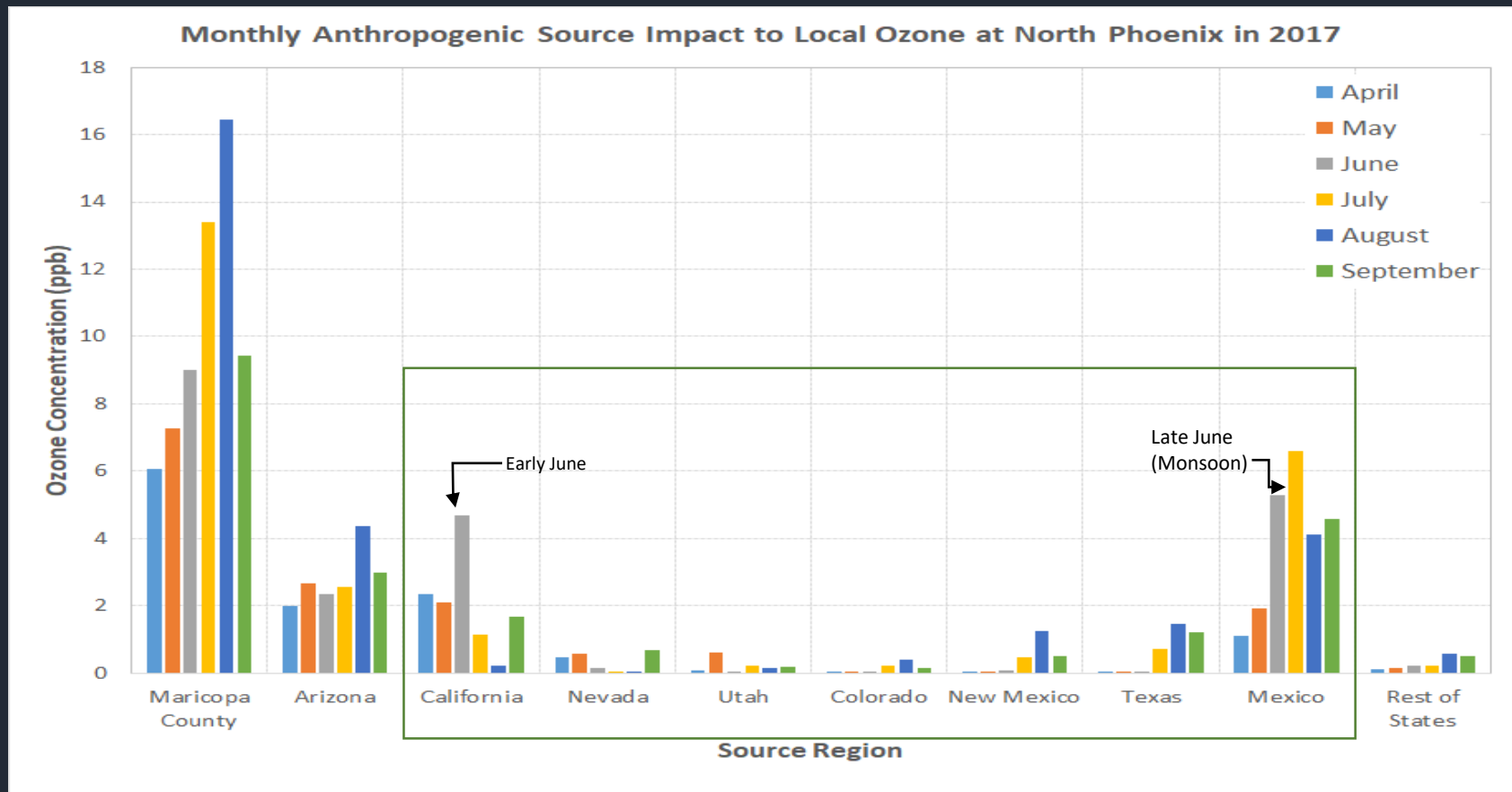
Monsoon



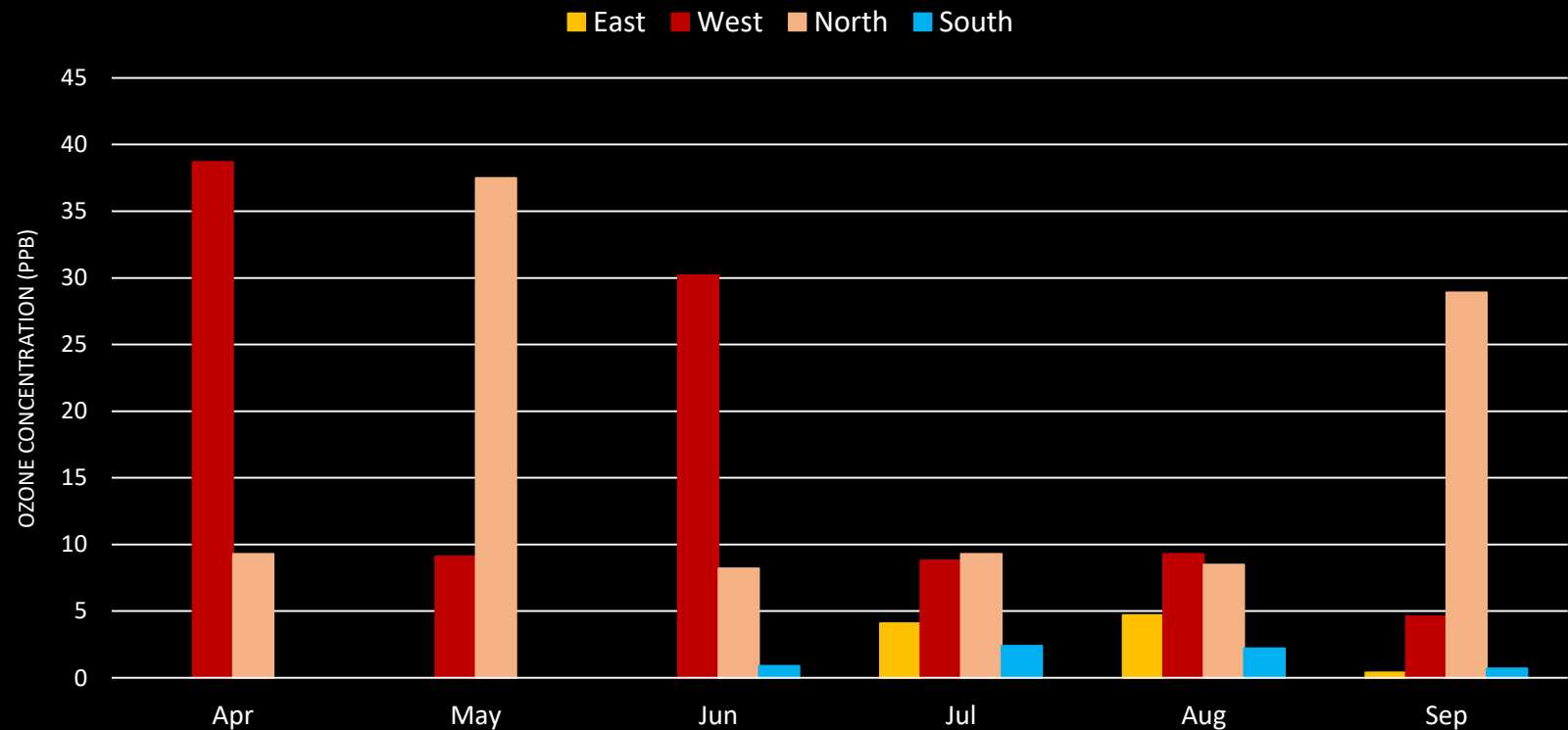
Air Temperature at 2m (F)



Man-Made Emission Impacts on Ozone at North Phoenix Monitor



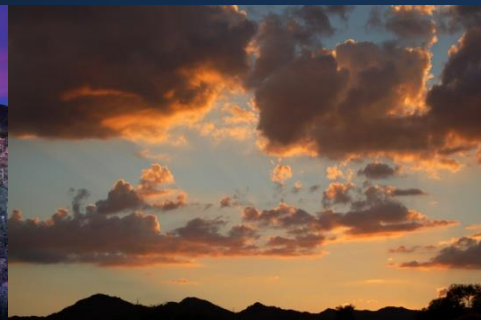
Background Ozone and Precursors Transport Impact on Ozone at North Phoenix Monitor in 2017



Summary of Impacts on Ozone in 2020

- **COVID-19 restrictions in 2020 did influence local man-made emissions and ozone production in the Maricopa eight-hour ozone nonattainment area. However, the impact of COVID-19 restrictions were obscured by:**
 - **East Asia air pollutant transport was higher in April and May 2020 than in 2019.**
 - **Wildfires in August and September 2020 were much more extensive and extreme than in 2019.**
 - **Temperatures and biogenic emissions were generally higher during the ozone season in 2020.**
 - **California and Northwest air pollutant transport is prominent before the monsoon (April – early June), while Mexico air pollutant transport and local emission impacts are higher during monsoon season.**





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